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Theme session 4

Weber Fractions and Time-Order Errors for long and short durations: Implications for modeling

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Often, discrimination sensitivity is studied by a 2AFC method, keeping one stimulus as a standard and letting the other vary around it. According to the commonly assumed Difference Model for comparison, it should not matter whether the first stimulus is fixed and the second varied (Standard-Comparison, St-Co), or vice versa (Comparison-Standard, Co-St). The aim of this study was to study Weber Fractions (WFs) and Time-Order Errors (TOEs) as a function of interval duration and presentation order of St and Co for four different types of intervals.

Using a weighted up-down procedure, in each of eight conditions 28 participants compared successve interval durations with an ISI of 900 ms: St was 100 or 1000 ms (blocked). In each block, orders St-Co and Co-St were intermixed. Thus block types for each St were [St<Co, Co>St] and [St>Co, Co<St]. Interval types (blocked) were auditory (noise bursts) or visual (LED flashes); filled, or unfilled with 3-ms markers (between-groups); with or without correctness feedback (between-groups). Upper and lower thresholds (for 75 % correct) were used to determine JND and PSE, and thereby WF = JND/St and TOE = $\pm$(PSE$-$St).

For all interval types, TOEs were negative for St = 1000 ms, and positive for St = 100 ms. Feedback lowered WFs by 15–20 %, but all interactions with Feedback were nonsignificant. For auditory-unfilled (AU; only 100 ms used) WF did not differ between orders. For visual-filled (VF), WFs were significantly higher with Co-St than with St-Co; thus varying the 1st stimulus had a lesser impact on the response than varying the 2nd stimulus. In analogy with the definition of the TOE, also called Type-A effect (negative when the 1st stimulus is perceived as being of lower magnitude than an identical 2nd stimulus), this Type-B effect should be called negative. Positive Type-B effects were obtained as well: For visual-unfilled (VU) and auditory-filled (AF), WFs were highest with Co-St for 1000 ms, but with St-Co for 100 ms. The interactions of Order $\times$ Duration were highly significant. The effects refute the Difference Model, and suggest a flexible impact ratio of the 1st and the 2nd stimulus.

For AF intervals, the TOE and WF data confirm earlier results[1]. For TOEs, the results demonstrate the common effect of stimulus level – negative TOE for long, but positive TOE for short durations. These effects refute an explanation by simple response bias. The results confirm that WFs are affected by whether the 1st or the 2nd stimulus is varied, but refute the generalization that WFs are always lower with St-Co than with Co-St. For AF and VU, varying the first stimulus (order Co-St) has a higher impact on the response, as shown by smaller WFs, than varying the second (order St-Co). The Sensation Weighting Model[2,3] can account for these effects, and also for positive as well as negative TOEs.

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